

## PATENT ABSTRACTS OF JAPAN

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(71)Applicant : HITACHI LTD

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(72)Inventor : ENDO TAKESHI  
KATSUMATA NAOTO  
TERADA KOJI  
KOKUNI KENSAKU  
MATSUSHIMA HIROAKI  
KOGURE HIROSHI

## (54) REFRIGERANT CHANGE METHOD OF AIR CONDITIONER

## (57)Abstract:

PURPOSE: To obtain a refrigerant change method which allows an air conditioner, which uses a refrigerant of a fluorinated hydrocarbon containing chlorine as a working fluid, to adapt to a new chlorine-free refrigerant with existing equipment used and changes minimized.

CONSTITUTION: First, refrigerant of HCFC 22 is recovered into an outdoor unit. Second, the outdoor unit is replaced with a new outdoor unit adaptable to a new mixed refrigerant of HFC 32/HFC 125/HFC 134a. Third, evacuation is carried out to charge the new refrigerant.

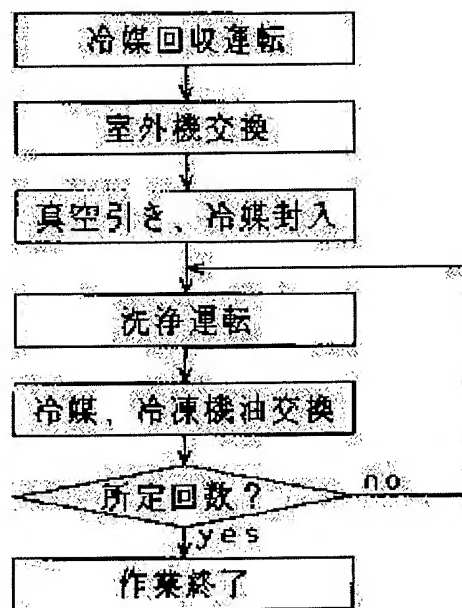
Fourth, an air conditioner is operated for a specified period of time to perform cleaning operation. Fifth, the refrigerant and refrigerating machine oil are replaced.

The fourth and fifth operation are repeated specified times. Thus, the working fluid of the air conditioner is replaced with the new refrigerant. Therefore, this

refrigerant change method is economical as saving of equipment and a reduction in working period and working space can be attained. In addition, the reliability of

equipment and performance of air-conditioning are improved and the air conditioner can be

adapted to the new refrigerant.



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## CLAIMS

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[Claim(s)]

[Claim 1] In the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit After performing recovery operation, with the fluorohydrocarbon system refrigerant built in which contains said chlorine in said exterior unit It permutes by the new exterior unit having the new refrigerating machine oil which suited the fluorohydrocarbon system refrigerant which does not contain said chlorine in said exterior unit. After enclosing with said air conditioner the fluorohydrocarbon system refrigerant which carries out vacuum suction of said exterior unit and said interior unit, and does not contain said chlorine, The refrigerant modification approach of the air conditioner characterized by repeating washing operation on which only predetermined time operates said air conditioner and does the exchange activity which replaces the fluorohydrocarbon system refrigerant which does not contain said chlorine after that, and said new refrigerating machine oil, and which it becomes from operation and said exchange activity of said predetermined time more than the count of predetermined.

[Claim 2] Said count of predetermined is the refrigerant modification approach of the air conditioner according to claim 1 characterized by what was defined based on the concentration of the fluorohydrocarbon system refrigerant containing said chlorine which remains to said air conditioner.

[Claim 3] The refrigerant which does not contain said chlorine is the refrigerant modification approach of the air conditioner according to claim 1 or 2 characterized by consisting of either HFC32, HFC125, HFC134a, HFC143a and HFC152a and those combination.

[Claim 4] For said exterior unit, said new exterior unit is the refrigerant modification approach of the air conditioner according to claim 1 characterized by only compressors differing.

[Claim 5] In the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system refrigerant refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit Liquid cooling intermediation piping and gas refrigerant piping which connect said exterior unit and said interior unit, At least one in the control signal transmission line is diverted as it is. Said exterior unit and said interior unit The refrigerant modification approach of the air conditioner which carries out vacuum suction after permuting by the new exterior unit and new interior unit corresponding to the fluorohydrocarbon system refrigerant which does not contain said chlorine, and is characterized

by enclosing the fluorohydrocarbon system refrigerant which does not contain said chlorine.

[Claim 6] The refrigerant modification approach of the air conditioner according to claim 5 characterized by to repeat washing operation on which only predetermined time operates said air conditioner and does the exchange activity which replaces the fluorohydrocarbon system refrigerant which does not contain said chlorine after that, and said new refrigerating machine oil, and which it becomes from operation and said exchange activity of said predetermined time more than the count of predetermined after enclosing the fluorohydrocarbon system refrigerant refrigerant which performs vacuum suction and does not contain chlorine.

[Claim 7] In the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system mixing refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit After performing recovery operation, with the fluorohydrocarbon system refrigerant built in which contains said chlorine in said exterior unit It permutes by the new exterior unit having the new refrigerating machine oil which suited the fluorohydrocarbon system mixing refrigerant which does not contain said chlorine in said exterior unit. After enclosing with said air conditioner the washing refrigerant which has at least 1 component of the fluorohydrocarbon system mixing refrigerant which carries out vacuum suction of said exterior unit and said interior unit, and does not contain said chlorine, The refrigerant modification approach of the air conditioner characterized by repeating washing operation on which only predetermined time operates said air conditioner and does the exchange activity which replaces said washing refrigerant and said new refrigerating machine oil after that, and which it becomes from operation and said exchange activity of said predetermined time more than the count of predetermined.

[Claim 8] The refrigerant modification approach of the air conditioner according to claim 5 or 7 characterized by attaching the transmission signal converter which changes a transmission signal format, and transmitting said washing train operation dispatching between the new exterior unit permuted by the control signal transmission line which transmits the control signal which controls said exterior unit and said interior unit, or a new interior unit.

[Claim 9] In the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit After performing recovery operation, with the fluorohydrocarbon system refrigerant built in which contains said chlorine in said exterior unit It permutes by the new exterior unit having the new refrigerating machine oil which suited the fluorohydrocarbon system refrigerant which does not contain said chlorine in said exterior unit. After enclosing with said air conditioner the fluorohydrocarbon system refrigerant which carries out vacuum suction of said exterior unit and said interior unit, and does not contain said chlorine, Only predetermined time operates said air conditioner and does the exchange activity with which the fluorohydrocarbon system refrigerant which does not contain said chlorine after that, and said new refrigerating machine oil are replaced. The refrigerant modification approach of the air conditioner characterized by installing the display object in which it is shown that the refrigerant was changed after repeating washing operation which consists of operation and said exchange activity of said predetermined time more than the count of predetermined in said air conditioner.

[Claim 10] The refrigerant which does not contain said chlorine is claim 5 characterized by consisting of either HFC32, HFC125, HFC134a, HFC143a and HFC152a and those combination, or the refrigerant modification approach of an air conditioner according to claim 7 or 9.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the refrigerant modification approach of a suitable air conditioner to start the refrigerant modification approach of the air conditioner which uses the fluorohydrocarbon system refrigerant containing chlorine as working fluid, especially divert the existing device, and change working fluid into a non-chlorine new refrigerant.

[0002]

[Description of the Prior Art] Conventionally, the fluorohydrocarbon system refrigerant containing chlorine, such as the so-called CFC and HCFC, has been used abundantly as working fluid of a refrigerating cycle for the outstanding thermodynamic property and stability. <> And when remove temporarily because of maintenance of a device, or repair the device which constitutes the air conditioner which uses such a refrigerant, exchanging them according to failure or superannuation or transferring them, the so-called pump-down operation which carries out recovery operation of the refrigerant before the decomposition was carried out. The example is indicated by JP,62-280548,A.

[0003]

[Problem(s) to be Solved by the Invention] In the above-mentioned conventional technique, it was not taken into consideration even about modification of the device by modification of the class of refrigerant. That is, the fluorohydrocarbon system matter containing chlorine reaches to a stratosphere by the convection current, without decomposing for the stability. And it photodissociates by strong ultraviolet rays high up in the sky, and ozone and the chlorine atom which reacts are separated. It is becoming clear that the operation by which an ozone layer is destroyed arises by this. Therefore, in order to protect the ozone layer which serves to interrupt ultraviolet rays harmful to the body high up in the sky, abolition of the fluorohydrocarbon system matter containing chlorine is determined. Although the effect to ozone layer depletion is smaller than CFCs HCFC22 widely used as a refrigerant of an air conditioner or a refrigerator is also the object, and is [ kinds ] the so-called chlorofluorocarbon, to substitute within several years is demanded. <> HFC32 and HFC125 of the fluorohydrocarbon which does not contain the chlorine which caused ozone layer depletion as a new refrigerant currently examined as an alternative candidate of the conventional refrigerant of current and HCFC22 grade, HFC134a, HFC143a, and HFC152a -- it is thought that either or two or more mixing refrigerant which mixed some in them is promising.

[0004] by the way, the thing which is already installed and is working even if the product corresponding to a new refrigerant will be thrown into a commercial scene from now on -- in addition, although what is manufactured and sold between the present to a change will be doubled and the device of a considerable number will work as a conventional machine It is as above-mentioned that it is expected conventionally that it becomes difficult by a termination and contraction of manufacture to receive a refrigerant and that use becomes difficult by strengthening of regulation, and the alternative is needed. Therefore, it is necessary to use the existing device effectively and to deal with a new refrigerant by the minimum modification.

[0005] Then, if the changed part of the device considered to be needed when a refrigerant and refrigerating machine oil change is got concretely It pushes and removes. Compressor items, such as volume and a compression ratio, the compressor operation frequency control approach and the amount of expansion equipment diaphragms, Container volume, such as a bypass flow

rate for refrigerating cycle control, a receiver, and an accumulator, There are use of heat exchanger capacity, a heat exchanger pass array, the proof-pressure structure of components, the amount of compressor oil supply, the amount of accumulator oil returning, a line size, and the ingredient corresponding to a new refrigerant / new refrigerating machine oil, use of the drying agent which adsorbs moisture at the refrigerating machine oil which is easy to contain moisture, etc.

[0006] By the way, even if the new refrigerant points to the thing of the property conventionally near a refrigerant and does not change it about said all changed parts for this reason, it may divert most existing most [ parts or ], and may be able to be equivalent to a new refrigerant. In said changed part, if the amount of expansion equipment diaphragms, heat exchanger capacity, a heat exchanger pass array, the proof-pressure structure of components, a line size, and the ingredient corresponding to a new refrigerant / new refrigerating machine oil can be used as it is, an interior unit and refrigerant piping at least do not need to change. About this, it is using the mixed refrigerant of HFC32/HFC125/HFC134a, for example, and although accompanied by the fall of some of engine performance, an interior unit and refrigerant piping have high possibility that a refrigerant use device can be used as it is conventionally. And if the remaining changed parts belong to an exterior unit and exterior units are exchanged the whole round head, they are changeable into the air conditioner corresponding to a new refrigerant about a device.

[0007] On the other hand, if a refrigerant changes, it will be necessary to also change refrigerating machine oil into the thing corresponding to it. However, since compatibility is remarkable and an above-mentioned new refrigerant is conventionally [ which makes straight mineral oil, alkylbenzene, etc. a subject ] low to refrigerating machine oil, conventional refrigerating machine oil cannot be used. Then, the new refrigerating machine oil which secured compatibility with a new refrigerant with the ether system or the ester system division-into-equal-parts child polarity will be used.

[0008] By the way, if a refrigerant remains and mixes refrigerating machine oil and conventionally conventionally which contains the chlorine-based matter in the refrigerating cycle which applied the new refrigerant, it will become the cause of chemical change of a new refrigerant and new refrigerating machine oil. For example, the corrosion of the ingredient in a refrigerating cycle by generating of an acid is raised, and there is a possibility of reducing the dependability of a product remarkably. Moreover, it may not restrict that no the ingredients with which affinity with refrigerating machine oil is checked a refrigerant and conventionally conventionally which is used for the conventional device can use it satisfactory also about a new refrigerant and new refrigerating machine oil, but corrosion, damage on the device by swelling, and the fall of seal nature may arise. Furthermore, if refrigerating machine oil remains so much conventionally without a new refrigerant and compatibility, when the inside of an evaporator is low temperature, separation for a wax will arise and it will become the cause of the heat transfer performance degradation by the adhesion in tubing, or plugging. That is, there is a possibility that dependability and the engine performance may not be securable only by performing exchange of a device and a refrigerant. Therefore, in diverting the existing device which used the refrigerant conventionally and making a new refrigerant correspond, the approach which considered the above-mentioned point is needed.

[0009] Moreover, as mentioned above, since the conventional refrigerant of HCFC22 grade destroys an ozone layer even if there is a difference in extent of effect, it needs to avoid emission into atmospheric air as much as possible. <> In order to make a new refrigerant correspond, when an exterior unit or an interior unit is further changed into the device corresponding to a new refrigerant, there is a possibility that the number of need wiring and connection connector configuration of a signal-transmission line for control may be changed. It is also considered that the formats of the informational contents or a control signal transmitted moreover differ, and there is also a possibility that connection of a device cannot be performed in the nonconformance of an exterior unit, an interior unit, and the control signal transmission line.

[0010] The purpose of this invention is to divert the existing device which was using the refrigerant conventionally and offer the approach of being the minimum modification and

changing a refrigerating cycle into the thing corresponding to a new refrigerant easily and economically.

[0011] Even if it changes other purposes of this invention so that the existing device which was using the refrigerant conventionally may be diverted and it may correspond to a new refrigerant, they are to offer the refrigerant modification approach of an air conditioner which secures the dependability of a device and does not spoil the engine performance.

[0012] The purpose of further others of this invention is not to do damage to an environment and offer [ do not destroy an ozone layer without emitting a refrigerant into atmospheric air as much as possible, but also make recycle possible, ] the economical refrigerant modification approach of an air conditioner, without using special equipment.

[0013] When changing so that the existing device which was using the refrigerant conventionally may be diverted and it may correspond to a new refrigerant, even if other purposes of this invention have a nonconformance part on control signal transmission between the device corresponding to the changed new refrigerant, and the control signal transmission line or the interior unit to divert, they are to offer the refrigerant modification approach of an air conditioner which enabled it to connect, without changing these devices.

[0014]

[Means for Solving the Problem] In the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit in order to solve the above-mentioned technical problem After performing recovery operation, with the fluorohydrocarbon system refrigerant built in which contains said chlorine in said exterior unit It permutes by the new exterior unit having the new refrigerating machine oil which suited the fluorohydrocarbon system refrigerant which does not contain said chlorine in said exterior unit. After enclosing with said air conditioner the fluorohydrocarbon system refrigerant which carries out vacuum suction of said exterior unit and said interior unit, and does not contain said chlorine, Said air conditioner is operated, and only predetermined time does the exchange activity which replaces the fluorohydrocarbon system refrigerant which does not contain said chlorine after that, and said new refrigerating machine oil, and it is made to repeat washing operation which it becomes from operation and said exchange activity of said predetermined time more than the count of predetermined.

[0015] Moreover, it sets to the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit. Liquid cooling intermediation piping and gas refrigerant piping which connect said exterior unit and said interior unit, At least one in the control signal transmission line is diverted as it is, after permuting said exterior unit and said interior unit by the new exterior unit and new interior unit corresponding to the fluorohydrocarbon system refrigerant which does not contain said chlorine, vacuum suction is carried out, and the fluorohydrocarbon system refrigerant which does not contain said chlorine is enclosed.

[0016] Furthermore, it sets to the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system mixing refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit. After performing recovery operation, with the fluorohydrocarbon system refrigerant built in which contains said chlorine in said exterior unit It permutes by the new exterior unit having the new refrigerating machine oil which suited the fluorohydrocarbon system mixing refrigerant which does not contain said chlorine in said exterior unit. After enclosing with said air conditioner the washing refrigerant which has at least 1 component of the fluorohydrocarbon system mixing refrigerant which carries out vacuum suction of said exterior unit and said interior unit, and does not contain said chlorine, Only predetermined time operates said air conditioner, does the exchange activity with which said washing refrigerant and said new refrigerating machine oil are



replaced after that, and repeats washing operation which it becomes from operation and said exchange activity of said predetermined time more than the count of predetermined.

[0017] Moreover, it sets to the refrigerant modification approach of an air conditioner changed into the fluorohydrocarbon system refrigerant which does not contain chlorine from the fluorohydrocarbon system refrigerant which contains chlorine for the actuation refrigerant of the air conditioner equipped with the interior unit and the exterior unit. After performing recovery operation, with the fluorohydrocarbon system refrigerant built in which contains said chlorine in said exterior unit It permutes by the new exterior unit having the new refrigerating machine oil which suited the fluorohydrocarbon system refrigerant which does not contain said chlorine in said exterior unit. After enclosing with said air conditioner the fluorohydrocarbon system refrigerant which carries out vacuum suction of said exterior unit and said interior unit, and does not contain said chlorine, Only predetermined time operates said air conditioner and does the exchange activity with which the fluorohydrocarbon system refrigerant which does not contain said chlorine after that, and said new refrigerating machine oil are replaced. After repeating washing operation which consists of operation and said exchange activity of said predetermined time more than the count of predetermined, the display object in which it is shown that the refrigerant was changed is installed in said air conditioner.

[0018]

[Function] In changing the refrigerant of an air conditioner into what suits regulation, the exchange activity of devices other than an exterior unit becomes unnecessary by diverting an exterior unit, refrigerant piping, and the control signal transmission line as it is, and permuting by the new exterior unit having the new refrigerating machine oil which is adapted for said new refrigerant in an exterior unit with the compressor corresponding to the new refrigerant which does not contain chlorine, a control unit, an collimator, a heat exchanger, and refrigerating cycle piping. Therefore, reduction of replacement parts cost, reduction of construction cost, and compaction of a construction period are achieved. <> Only in the case of the compressor corresponding to the new refrigerant with which exchanging enclosed new refrigerating machine oil again, low cost-ization is attained more. <> Further, in diverting liquid cooling intermediation piping, gas refrigerant piping, or all the control signal all [ either or ] as it is, that what is necessary is to permute only an exterior unit and an interior unit, the activity of the comparatively easy part of exchange serves as a subject, and the troublesome activity which takes about piping and wiring becomes unnecessary.

[0019] Moreover, the new refrigerant which is incongruent to the thermal property of the new refrigerant which does not contain chlorine, or does not contain chlorine, Or the refrigerating cycle components of an air conditioner using an incongruent ingredient to the new refrigerating machine oil which can be equivalent to the new refrigerant which does not contain chlorine By exchanging for the \*\*\*\*\* components in which mixture use with the new refrigerant and new refrigerating machine oil which suit the thermal property of the new refrigerant which does not contain chlorine, and do not contain chlorine is possible, the configuration equipment of other most can be diverted as it is, and low cost-ization is attained. <> Refrigerants can be collected easily, without using machines, such as a refrigerant recovery system of dedication, while not emitting almost all refrigerants into atmospheric air and controlling destruction of an ozone layer by performing recovery operation of the fluorohydrocarbon system refrigerant containing the chlorine in an exterior unit again. Furthermore, a fixed time amount air conditioner is operated and washing operation which considers changing for the new refrigerating machine oil which suits the new refrigerant which does not contain chlorine after that, and a new refrigerant as a series of activities is carried out at the time of refrigerant exchange. And since it repeats until the concentration of refrigerating machine oil turns into below threshold limit value conventionally which suited the fluorohydrocarbon system refrigerant containing the fluorohydrocarbon system refrigerant and chlorine containing the chlorine which remains this activity of a series of in a refrigerating cycle, refrigerating-machine-oil concentration thins [ refrigerating machine oil ] conventionally [ residual ] in return and a refrigerating cycle in a compressor conventionally [ remaining ]. Thereby, the amount of residuals of refrigerating machine oil turns into a minute amount a refrigerant and conventionally conventionally,

conventionally, a refrigerant and conventionally, acid generating by the residual of refrigerating machine oil and the deposit for a wax can be prevented, and breakage of the motor burning accident in which the ingredient in a device by acid content carries out a corrosion reason, and the device by a bearing life fall and the increment in corrosive wear of the sliding section can be prevented. Moreover, decline in heat transfer performance degradation, the air-conditioning capacity by the increment in tubing internal pressure loss, and effectiveness etc. can be prevented by part for the wax which adhered in the evaporator tube wall.

[0020] Furthermore, in washing operation for changing into the new refrigerant which does not contain the chlorine which consists of a two or more-component mixed component, if only the refrigerant of one component in the component which constitutes a new refrigerant is used for washing operation, compared with the refrigerant of a unit intelligence sentence, the amount of the expensive new refrigerant used can be reduced, and it will become cheap.

[0021] Moreover, if the inverter which changes the conversion connector or transmission signal format of a control signal transmission-line connection connector is attached between the exterior units or interior units exchanged for the control signal transmission line to divert, the connection improper by the connector configuration inequality of the exterior unit corresponding to the new refrigerant exchanged for the control signal transmission line to divert or an interior unit or a wiring terminal processing activity will become unnecessary. In addition, if an interior unit is diverted and only exterior units are exchanged, even if the contents of transmission information differ from the format, the transmission information from an exterior unit will be conventionally changed into the transmission signal format of a refrigerant use device. On the contrary, the transmission information from an interior unit is changed into the transmission signal format of the device corresponding to a new refrigerant. When lack is in the contents of transmission information, by inserting dummy data suitably, a device halt by the transmission error can be prevented and reconstruction of a device and the device corresponding to a new refrigerant to exchange becomes unnecessary conventionally to divert.

[0022] Moreover, if the display object in which it is shown that the refrigerant was changed is prepared in an air conditioner after the refrigerant exchange activity to a new refrigerant from a refrigerant is completed conventionally Also when a maintenance of a refrigerating cycle is needed again after the refrigerant exchange activity to a new refrigerant was completed, since it specifies that the display object is already equivalent to the new refrigerant to the air conditioner concerned which is conventionally visible to a refrigerant use device, error business can be prevented from appearance. And the breakage and degradation of a device by the resealing close of a refrigerant can be prevented conventionally.

[0023]

[Example] The conventional air conditioner is explained according to introduction, drawing 8 , and drawing 9 . <> Drawing 8 is drawing having shown the configuration of the conventional air conditioner, and uses HCFC22 for working fluid. And it is an example of the multi-package air conditioner for buildings which has two or more interior units to one set of an exterior unit. In exterior unit 10q, compressor 1q, outdoor heat exchanger 2q, outdoor blower 3q, Outdoor expansion equipment 4q, four-way-valve 5q, accumulator 6q, receiver 7q, gas side inhibition valve 11q, liquid side inhibition valve 12q, liquid side check valve 13q, and refrigerant piping that connects these, Outdoor control unit 8q which controls compressor 1q, outdoor blower 3q, outdoor expansion equipment 4q, etc. is contained by the various information from the pressure of a refrigerating cycle and temperature, and the indoor control units 24a, 24b, and 24c, and the main parts are held into one case using it.

[0024] The indoor heat exchangers 21a, 21b, and 21c and the indoor expansion equipments 23a, 23b, and 23c which were respectively connected with two or more interior units 20a, 20b, and 20c for refrigerant piping on the other hand, Suction temperature, blowdown temperature, remote control switches 25a, 25b, and 25c, Or it has the indoor control units 24a, 24b, and 24c which control the indoor blowers 22a, 22b, and 22c and the indoor expansion equipments 23a, 23b, and 23c by information from outdoor control unit 8q, and holds into the case, respectively. These exterior unit 10q and interior units 20a, 20b, and 20c are connected by the gas refrigerant piping 31 and the liquid cooling intermediation piping 32. Furthermore, the control signal transmission



line 33 crosses between outdoor control unit 8q and the indoor control units 24a, 24b, and 24c, and it connects. Moreover, drain piping 34 which drains the moisture which dewes indoor heat exchangers 21a, 21b, and 21c at the time of air conditioning operation is formed in interior units 20a, 20b, and 20c. In addition, outdoor power-source wiring 35q from a power source and the indoor power-source wiring 36a, 36b, and 36c are connected to outdoor control unit 8q and the indoor control units 24a, 24b, and 24c, respectively, and power is supplied.

[0025] Drawing 9 is drawing (a worker is not shown) showing the interior unit \*\*\*\* attachment condition of the conventional air conditioner, and shows signs that the interior unit of the head-lining embedding cassette type which occupies the mainstream of an interior unit in recent years with the advantage which does not take an installation tooth space is attached. The gas refrigerant piping 41, the liquid cooling intermediation piping 42, and the control signal transmission line 43 which were connected to the interior unit 40 are put in block, and it connects with the exterior unit which is covered with a heat insulator in the perimeter, and is in the roof. Moreover, each drain piping 44 is connected with drain piping of other interior units, turns into piping of one, and is connected to facilities for drainage. These piping wiring is laid underground into the underpart of the roof or a wall like drawing 9. <> At the multi-package air conditioner for buildings, in order that such dozens of interior units may be formed in the same story from several sets and much they may straddle a story further, it is accompanied by the remarkable activity only by construction of these piping. And when installing in a new-building housing, construction of these piping can be finished before initiation of an interior finish work, there is neither head lining nor a wall surface, and it can install comparatively easily, but in once being concealed by head lining and the wall after being installed, since the interior of a room is used for the original application, it is hard to do an activity.

[0026] How to make a refrigerant use air-conditioning machine correspond to a new refrigerant is explained using drawing 1 thru/or drawing 4, and drawing 8 such conventionally that has already been installed. <> Drawing 1 is the activity flow Fig. of one example of this invention. Drawing 2 is drawing having shown the configuration of one example of this invention, and the difference from drawing 8 is to have exchanged exterior unit 10q for the new exterior unit 10 corresponding to a new refrigerant. Namely, refrigerant piping which connects a compressor 1, an outdoor heat exchanger 2, the outdoor blower 3, outdoor expansion equipment 4, a four way valve 5, an accumulator 6, a receiver 7, a dryer 9, the gas side inhibition valve 11, the liquid side inhibition valve 12, the liquid side check valve 13, and these and the pressure of a refrigerating cycle, The outdoor control unit 8 grade which controls a compressor 1, the outdoor blower 3, and outdoor expansion equipment 4 grade by information from temperature or the indoor control units 24a, 24b, and 24c is held into one case. And the new refrigerating machine oil corresponding to a new refrigerant, for example, polyol-ester system oil, is beforehand enclosed with the compressor 1. Drawing 3 is drawing having shown the exterior unit exchange activity situation of one example of this invention. Moreover, drawing 4 is drawing showing the count of washing of one example of this invention, and the relation of HCFC22 residual concentration.

[0027] Hereafter, according to the activity flow Fig. of drawing 1, sequential explanation of the work habits is given about one example of this invention constituted in this way. <> Perform first (the 1st step) and refrigerant recovery operation of HCFC22 which is a refrigerant conventionally. This is a thing which removes exterior unit 10q the conventional refrigerant in a refrigerating cycle, and conventionally without emitting refrigerating machine oil into atmospheric air if possible and to perform for accumulating. First, the procedure closes the liquid side inhibition valve 12 of exterior unit 10q, makes it the pilot-run mode of air conditioning, and is operated for a while. Pilot-run mode is a function with which the conventional air conditioner is usually equipped, and is the mode operated continuously irrespective of ON/OFF of an interior unit, and laying temperature. If air conditioning operation is performed where liquid side inhibition valve 12q is closed, since the liquid cooling intermediation condensed to the outdoor heat exchanger cannot flow to an interior unit, refrigerants are gradually collected in exterior unit 10q. Operation is continued in the range in which a protective device does not operate, and after choosing a good time at one's own discretion and closing gas side inhibition valve 11q, pilot-run mode is canceled and it stops. According to this activity, most refrigerants in a refrigerating

cycle will be in the condition of having been collected by the exterior unit. If exterior unit 10q is removed from the gas refrigerant piping 31 and the liquid cooling intermediation piping 32 after emitting an interior unit and few refrigerants which remained into piping, the refrigerant emitted into atmospheric air is minimized, and refrigerants can be collected, without using a refrigerant recovery dedicated device etc.

[0028] Next, (the 2nd step), exterior units are exchanged. Old exterior unit 10q which removed the refrigerant conventionally is exchanged for the new exterior unit 10 corresponding to a new refrigerant, for example, a HFC32/HFC125/HFC134a mixing refrigerant, and the gas refrigerant piping 31, the liquid cooling intermediation piping 32, and the control signal transmission line 33 are connected. It is necessary to agree in the new exterior unit 10 in the property of the new refrigerating machine oil which suits physical properties, such as the thermodynamics property of a new refrigerant, and transport properties, for example, polyol-ester system oil. therefore , it pushed and removed and points , such as use of container volume , such as compressor items , such as a volume and a compression ratio , the compressor operation frequency control approach and the amount control approach of expansion equipment diaphragms , a bypass flow rate for refrigerating cycle control , a receiver , and an accumulator , heat exchanger capacity , a pass array , the proof pressure structure of components , the amount of compressor oil supply , the amount of accumulator oil returning , a line size , and the ingredient corresponding to a new refrigerant / new refrigerating machine oil and installation of the dryer which adsorb a moisture have change from the old exterior unit . Exchange can be easily carried out by exchanging the exterior unit which package-ized the compressor, the heat exchanger, the control device, etc.

[0029] In the exterior unit shown in drawing 2 currently installed in the roof as an example of exchange, a crane is used, and an exterior unit and a new exterior unit are taken out and carried in conventionally. Here, removed exterior unit 10q is sent to an appliance maker as it is. Then, an appliance maker or a recycle contractor does the ejection activity of a refrigerant, and the parts-replacement activity to the components corresponding to a new refrigerant. Thereby, saving-resources-izing by recycle of a refrigerant and a device and prevention of environmental pollution are achieved. In addition, although this example showed the example which can respond to new refrigerant use by exchange of only an exterior unit, when an interior unit also needs to be exchanged for the device corresponding to a new refrigerant, interior units 20a, 20b, and 20c are exchanged for the interior unit corresponding to a new refrigerant at this time.

[0030] At the following step (the 3rd step), vacuum suction is performed and a new refrigerant is enclosed. That is, if the vacuum suction which discharges a refrigerant conventionally which remains in the air in interior units 20a, 20b, and 20c, the gas refrigerant piping 31, and the liquid cooling intermediation piping 32 and a refrigerating cycle is completed, the gas side inhibition valve 11 and the liquid side inhibition valve 12 will be opened, and a new refrigerant will be enclosed. <> The following step (the 4th step) is washing operation further. This carries out predetermined time operation of the air conditioner in the pilot-run mode carried out previously, circulates a new refrigerant and new refrigerating machine oil in a refrigerating cycle, returns refrigerating machine oil to a compressor conventionally which remains by circulation of a refrigerant and refrigerating machine oil in interior units 20a, 20b, and 20c, the gas refrigerant piping 31, and the liquid cooling intermediation piping 32, and thins residual concentration. As predetermined time which carries out washing operation, refrigerating machine oil makes the inside of a refrigerating cycle 2 hours in consideration of extent of which a round is taken in general. An air conditioner is stopped after predetermined time progress. <> Replace refrigerating machine oil with a refrigerant at the following step (the 5th step). While collecting refrigerants from liquid side inhibition valve 12 grade, the refrigerating machine oil which removes a compressor 1 from the new exterior unit 10, and is in a compressor 1 is discharged. And intact new refrigerating machine oil is enclosed with a compressor 1, and is returned to the new exterior unit 10. Furthermore vacuum suction is carried out and a new refrigerant is enclosed. <> By repeating the 4th step in front of one more further with this 5th step, refrigerating machine oil decreases in number gradually from the amount of initial residuals a refrigerant and conventionally conventionally which remains in a refrigerating cycle. This activity is repeated the number of predetermined times, and it is made for the residual concentration of refrigerating

machine oil to serve as a minute amount a refrigerant and conventionally conventionally to the range which can maintain the dependability of a device.

[0031] Here, the count of predetermined required for recovery of the old refrigerant is explained. That the chlorine-based matter which contains a refrigerant conventionally exists in the refrigerating cycle which uses a new refrigerant and new refrigerating machine oil becomes the cause of carrying out decomposition degradation of the new refrigerant, and generating acid content. The permission yield of this acid content determines experimentally or theoretically the permissible level of the residual concentration of the chlorine-based matter which contains a refrigerant conventionally under this condition from compressor life test etc. as the corrosion of the ingredient used for a refrigerating cycle noting that it is extent which is not \*\* about effect. Signs that the amount of residuals of refrigerating machine oil decreases a refrigerant and conventionally conventionally which remains in a refrigerating cycle by replacing a refrigerant and refrigerating machine oil and on the other hand repeating washing operation are beforehand checked in a tentative way with the system. After exchanging a refrigerant and refrigerating machine oil and carrying out washing operation, those change is quantitatively grasped by sampling a refrigerant and refrigerating machine oil, and a gas chromatograph detecting the chlorine-based matter containing HCFC22, or measuring the acid-content content by the neutralization value test method. The turnover rate of the refrigerant with which the residual concentration of the chlorine-based matter which contains a refrigerant conventionally consists of these data below a permissible level, and refrigerating machine oil, and the count of washing operation can be decided.

[0032] The example of the relation of the concentration of the chlorine-based matter containing HCFC22 in the turnover rate of a refrigerant and refrigerating machine oil and the refrigerating cycle after washing operation is shown in drawing 4. A permissible level is the maximum concentration of the chlorine-based matter which is uninfluential in the fall of the dependability of a device, and if exchange of a refrigerant and refrigerating machine oil is carried out 3 times in this Fig., it turns out that chlorine-based matter concentration becomes below a permissible level. However, in this example, exterior units are exchanged, and since exchange of the 1st refrigerant and refrigerating machine oil which enclosed the new refrigerant is included, said count of predetermined becomes 2 times.

[0033] In addition, although it is certain if chlorine-based matter concentration is measured and exchange of a refrigerant and refrigerating machine oil is carried out whenever it performs washing operation to each case, if it is original, the drag-in of the measurement machine for chlorine-based matter density measurement is difficult, and it is most rational to carry out washing operation by the turnover rate decided beforehand as mentioned above in the actual site which time allowances to bring home and measure a sample do not have, either.

[0034] By the way, this example aims at finally changing a HFC32/HFC125/HFC134a mixing refrigerant into the air conditioner used for working fluid as a new refrigerant. However, in washing operation, the chlorine-based matter recovery in a refrigerating cycle is the purpose, and since there is no need for air conditioning during this activity, refrigerating capacity is not required of the refrigerant used for washing operation. Therefore, washing operation can also be carried out using refrigerants other than the refrigerant finally used. If the refrigerant which is one component in the component is used independently and washed, when using a mixed refrigerant like especially this example, while a cheap refrigerant can wash, since it is the matter with which compatibility with an ingredient or refrigerating machine oil is also checked, there is also no un-arranging about application. However, in the component in a mixed refrigerant, since there is also an object with difficult inflammable high thing and acquisition, this point needs to be considered.

[0035] In this example, it puts in practical use promptly as an alternative refrigerant of CFC12, and HFC134a which is excellent in availability or a price side is most suitable. Then, HFC134a is enclosed from the time of enclosure of the 3rd refrigerant of a step, washing operation is performed, HFC134a is used also for the refrigerant replaced at the 5th step, and washing operation is carried out repeatedly. At the time of refrigerant exchange of the last after washing operation becomes the count of predetermined, the HFC32/HFC125/HFC134a mixing refrigerant

which is the last refrigerant is enclosed. A cheap refrigerant can be used for washing by this, and a refrigerant can be changed economically. <> The cheap refrigerating machine oil from which the lubrication engine performance and endurance ability were dropped on extent which does not make use of a device produce a problem similarly about the refrigerating machine oil used for washing operation can also be used. Furthermore, it limits to a washing application, and the recovery nature of refrigerating machine oil is improved conventionally from which a fluidity adheres in tubing well in hypoviscosity, or additives, such as a chlorine part supplement agent and an acid supplement agent, are contained, and the refrigerating machine oil only for washing with the function to reduce the count of washing can also be used. <> As mentioned above, if the count of washing operation and exchange of a subsequent refrigerant and refrigerating machine oil becomes the count of predetermined, the refrigerant modification activity to a new refrigerant will be ended, and the usual operation will be performed henceforth. Thus, conversion is achieved a refrigerant and conventionally conventionally to the combination from the combination of refrigerating machine oil to a new refrigerant and new refrigerating machine oil.

[0036] Next, the operation procedure is explained about other examples of this invention according to the activity flow Fig. of drawing 5. It is only compressor 1q which is conventionally exchanged from a device, and that drawing 5 is different from the above-mentioned example is the point of using a refrigerant recovery dedicated device in refrigerant recovery operation of the 1st of a step. About others, it is the same as that of the above-mentioned example. That is, when installation of a dryer is unnecessary, or when it uses the new refrigerating machine oil which acid content does not generate from the moisture which refrigerating machine oil contains, and the compressor displacement control an electronic expansion valve is controlled based on a compressor regurgitation gas refrigerant degree of superheat, and according to selection operation of an inverter and two or more compressors is based on interior unit blowdown temperature, the thermal property of a control unit of a new refrigerant is [ the thing of a refrigerant ] the case where it can be used as it is, conventionally in the case of being conventionally close to a refrigerant. At this example, since the device to exchange is only a compressor, the conveyance amount of resources can respond to a new refrigerant by little easy activity. <> In addition, in order to make it correspond to the difference in a thermal property, control software, such as an electronic expansion valve and a compressor inverter operation frequency, may be changed to what was adapted for the new refrigerant, and the outdoor control unit 8 may be exchanged. Moreover, as long as residual moisture is a problem, a dryer connectable in the middle of refrigerant piping may be attached. All can use what can perform exchange and attachment easily lightweight as components.

[0037] Next, other examples of this invention are shown in drawing 6. Except having attached the control signal inverter 18 between the control signal transmission line 33 and the new exterior unit 10, it is the same as the configuration Fig. of the example of drawing 2. <> Since the connector configurations of the connection of the outdoor control unit 8 and the control signal transmission line 33 differ or the contents of transmission information and the format which the outdoor control unit 8 and the indoor control units 24a, 24b, and 24c transmit and receive differ from each other when exchanging exterior units and making a new refrigerant correspond like the example of above-mentioned drawing 2, this example is applied when it cannot do, if connection of a device remains as it is.

[0038] Here, actuation of the control signal inverter 18 is explained. The control signal inverter 18 has the transmission line of a connector configuration which has the connector configuration which can connect the control signal transmission line 33, and can connect with the outdoor control unit 8. And it connects with the outdoor control unit 8 between the control signal transmission lines 33, and communication of transmission information is enabled. Furthermore, the control signal inverter 18 changes the transmission information from the outdoor control unit 8 into the transmission signal format of a refrigerant use device conventionally, it transmits to the indoor control units 24a, 24b, and 24c, and it changes the transmission information from the indoor control units 24a, 24b, and 24c into the transmission signal format of the device corresponding to a new refrigerant conversely, and transmits it to the outdoor control unit 8. Under the present circumstances, when lack is in the contents of transmission information,

dummy data is inserted suitably and transmission information is transmitted. It can respond to a new refrigerant, without carrying out reconstruction of a device and the new exterior unit 10 to exchange conventionally which does not produce a transmission error by this and is diverted. [0039] Next, the example of further others of this invention is shown in drawing 7. Drawing 7 is drawing showing the example of a display object. <> Divert the existing device which used the refrigerant conventionally and stick a display object like drawing 6 on the location attached to an eye at the time of service of the air conditioner which changed working fluid into the new refrigerant which does not contain chlorine, for example, exterior unit external surface. This display object is giving an identifier indication of that the working fluid of this air conditioner is changed into the new refrigerant at least and the applied new refrigerant, and new refrigerating machine oil. It can prevent changing into the device corresponding to [ there is effectiveness to which the cautions in which this display object is already equivalent to the new refrigerant even if it is the air conditioner concerned which is conventionally / from appearance / visible to a refrigerant use device when maintaining by decomposing a refrigerating cycle again after a while after the refrigerant exchange activity to a new refrigerant is completed with this display object are urged, and ] a new refrigerant again, or carrying out resealing close [ of the refrigerant ] conventionally accidentally.

[0040]

[Effect of the Invention] While being able to perform refrigerant modification cheaply since the components to replace can be lessened as much as possible in case a refrigerant is changed into the new refrigerant which does not contain chlorine from the old refrigerant which contains chlorine in an air conditioner according to this invention, only a short-time activity is needed but an air conditioner can be economically changed into new refrigerant correspondence.

[0041] Moreover, since according to this invention it can collect without emitting almost all refrigerants into atmospheric air, while being able to control destruction of an ozone layer, the refrigerant recovery system of dedication etc. is not necessarily needed, but refrigerants can be collected easily. And since a refrigerant with the collected scarcity value can be used for recycle, environmental destruction can be avoided as much as possible, and an air conditioner can be made to correspond to a new refrigerant economically.

[0042] Furthermore, according to this invention, while the corrosion of the ingredient in a device by acid content can prevent accident, such as dielectric breakdown of a cause, it can prevent decline in heat transfer performance degradation, the air-conditioning capacity by the increment in tubing internal pressure loss, and effectiveness etc., and the dependability of a device and improvement in the engine performance of it are attained.

[0043]

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the activity flow Fig. of one example of invention.

[Drawing 2] It is the configuration Fig. of one example of this invention.

[Drawing 3] It is the exterior unit exchange activity situation map of one example of this invention.

[Drawing 4] It is drawing showing the count of washing of one example of this invention, and the relation of HCFC22 residual concentration.

[Drawing 5] It is the activity flow Fig. of other examples of this invention.

[Drawing 6] It is the configuration Fig. of other examples of this invention.

[Drawing 7] It is drawing showing the example of the display object of the example of further others of this invention.

[Drawing 8] It is the configuration Fig. of the conventional air conditioner.

[Drawing 9] It is drawing showing the interior unit \*\*\*\* attachment condition of the conventional air conditioner.

[Description of Notations]

1 1q -- 2 A compressor, 2q -- 3 An outdoor heat exchanger, 3q -- Outdoor blower, 4 4q -- 5 Outdoor expansion equipment, 5q -- 6 A four way valve, 6q -- Accumulator, 7 7q [ -- New exterior unit, ] -- 8 A receiver, 8q -- An outdoor control unit, 9 -- A dryer, 10 10q -- 11 An exterior unit, 11q -- 12 A gas side inhibition valve, 12q -- Liquid side inhibition valve, 13 13q -- A liquid side check valve, 18 -- Control signal inverter, 20a, 20b, 20c -- An interior unit, 21a, 21b, 21c -- Indoor heat exchanger, 22a, 22b, 22c -- An indoor blower, 23a, 23b, 23c -- Indoor expansion equipment, 24a, 24b, 24c [ -- Gas refrigerant piping, 42 / -- Liquid cooling intermediation piping, 43 / -- The control signal transmission line, 44 / -- Drain piping. ] -- An indoor control device, 25a, 25b, 25c -- A remote control switch, 40 -- An interior unit, 41

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(71) 出願人 000005108

株式会社日立製作所

東京都千代田区神田駿河台四丁目6番地

(72) 発明者 遠藤 剛

静岡県清水市村松390番地 株式会社日立  
製作所清水工場内

(72) 発明者 勝又 直登

静岡県清水市村松390番地 株式会社日立  
製作所清水工場内

(72) 発明者 寺田 浩二

静岡県清水市村松390番地 株式会社日立  
製作所清水工場内

(74) 代理人 弁理士 小川 勝男

最終頁に続く

(54) 【発明の名称】 空気調和機の冷媒変更方法

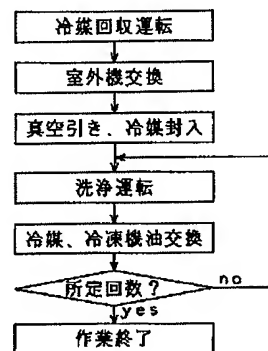
(57) 【要約】

【目的】塩素を含む弗化炭化水素系冷媒を動作流体とする空気調和機を、既存機器を流用して最小限の変更で、塩素を含まない新冷媒に対応可能にした冷媒変更方法を提供する。

【構成】初めに、H C F C 2 2 の室外機への冷媒回収運転を行い、次いで、室外機を新冷媒の H F C 3 2 / H F C 1 2 5 / H F C 1 3 4 a 混合冷媒に対応した新室外機に入れ換える。第3番目に、真空引きを行い新冷媒を封入し、第4番目に、空気調和機を所定時間運転して洗浄運転を実施する。第5番目に、冷媒と冷凍機油とを入れ替える。この、第4番目と第5番目の動作を、所定回数繰り返す。このようにして空気調和機の作動冷媒を新冷媒に置換する。

【効果】機器の節約、工事期間の節減及び作業領域の節減が図れ経済的である。また、機器の信頼性及び空調能力を向上させるとともに、空気調和機を新冷媒に対応させることができる。

図1



1

## 【特許請求の範囲】

【請求項1】室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系冷媒に変更する空気調和機の冷媒変更方法において、

前記室外機中に前記塩素を含む弗化炭化水素系冷媒を内蔵したまま回収運転を行った後に、前記室外機を前記塩素を含まない弗化炭化水素系冷媒に適合した新冷凍機油を内蔵した新室外機に置換し、前記室外機と前記室内機とを真空引きし、前記塩素を含まない弗化炭化水素系冷媒を前記空気調和機に封入した後、所定時間だけ前記空気調和機を運転し、その後に前記塩素を含まない弗化炭化水素系冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返すことを特徴とする空気調和機の冷媒変更方法。

【請求項2】前記所定回数は前記空気調和機に残留する前記塩素を含む弗化炭化水素系冷媒の濃度に基づいて定めたことを特徴とする請求項1に記載の空気調和機の冷媒変更方法。

【請求項3】前記塩素を含まない冷媒はHFC32、HFC125、HFC134a、HFC143aおよびHFC152aのいずれか、またはそれらの組合せからなることを特徴とする請求項1又は請求項2に記載の空気調和機の冷媒変更方法。

【請求項4】前記新室外機は前記室外機とは圧縮機のみが異なることを特徴とする請求項1に記載の空気調和機の冷媒変更方法。

【請求項5】室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系冷媒冷媒に変更する空気調和機の冷媒変更方法において、

前記室外機と前記室内機を接続する液冷媒配管及びガス冷媒配管と、制御信号伝送線との中の少なくとも1つをそのまま流用し、前記室外機と前記室内機とを、前記塩素を含まない弗化炭化水素系冷媒に対応した新室外機及び新室内機に置換した後に真空引きし、前記塩素を含まない弗化炭化水素系冷媒を封入することを特徴とする空気調和機の冷媒変更方法。

【請求項6】真空引きを行い塩素を含まない弗化炭化水素系冷媒冷媒を封入した後、所定時間だけ前記空気調和機を運転し、その後に前記塩素を含まない弗化炭化水素系冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返すことを特徴とする請求項5に記載の空気調和機の冷媒変更方法。

【請求項7】室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系混合冷媒に変更する空気調和機の冷媒変更方法において、

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前記室外機中に前記塩素を含む弗化炭化水素系冷媒を内蔵したまま回収運転を行った後に、前記室外機を前記塩素を含まない弗化炭化水素系混合冷媒に適合した新冷凍機油を内蔵した新室外機に置換し、前記室外機と前記室内機とを真空引きし、前記塩素を含まない弗化炭化水素系混合冷媒の少なくとも1成分を有する洗浄冷媒を前記空気調和機に封入した後、所定時間だけ前記空気調和機を運転し、その後に前記洗浄冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返すことを特徴とする空気調和機の冷媒変更方法。

【請求項8】前記室外機と前記室内機を制御する制御信号を伝送する制御信号伝送線と、置換した新室外機あるいは新室内機間に伝送信号フォーマットを変換する伝送信号変換装置を取り付け、前記洗浄運転指令を伝送することを特徴とする請求項5又は請求項7に記載の空気調和機の冷媒変更方法。

【請求項9】室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系冷媒に変更する空気調和機の冷媒変更方法において、

前記室外機中に前記塩素を含む弗化炭化水素系冷媒を内蔵したまま回収運転を行った後に、前記室外機を前記塩素を含まない弗化炭化水素系冷媒に適合した新冷凍機油を内蔵した新室外機に置換し、前記室外機と前記室内機とを真空引きし、前記塩素を含まない弗化炭化水素系冷媒を前記空気調和機に封入した後、所定時間だけ前記空気調和機を運転し、その後に前記塩素を含まない弗化炭化水素系冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返した後に冷媒が変更されたことを示す表示物を前記空気調和機に設置することを特徴とする空気調和機の冷媒変更方法。

【請求項10】前記塩素を含まない冷媒はHFC32、HFC125、HFC134a、HFC143aおよびHFC152aのいずれか、またはそれらの組合せからなることを特徴とする請求項5又は請求項7または請求項9に記載の空気調和機の冷媒変更方法。

## 【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、塩素を含む弗化炭化水素系冷媒を動作流体とする空気調和機の冷媒変更方法に係り、特に既存機器を流用して非塩素系新冷媒に動作流体を変更するのに好適な空気調和機の冷媒変更方法に関する。

【0002】

【従来の技術】従来、冷凍サイクルの動作流体として、いわゆるCFC、HCFC等の塩素を含む弗化炭化水素系冷媒が、その優れた熱力学的性質と安定性のために多用されてきた。◆そして、このような冷媒を使用する空

気調和機を構成する機器を、機器の整備や修理のために一時的に取り外したり、故障や老朽化により交換したり、あるいは移設したりするときに、その分解作業の前に冷媒を回収運転する、いわゆるポンプダウン運転が実施されていた。その例が、特開昭62-280548号公報に開示されている。

#### 【0003】

【発明が解決しようとする課題】上記従来技術においては、冷媒の種類の変更による機器の変更についてまでは考慮されていなかった。すなわち、塩素を含む弗化炭化水素系物質は、その安定性のために分解すること無く、対流によって成層圏へ到達する。そして、上空の強い紫外線により光分解し、オゾンと反応する塩素原子を遊離する。これにより、オゾン層が破壊される作用が生じることが明らかになってきた。そのため、人体に有害な紫外線を上空で遮る働きをするオゾン層を保護するために、塩素を含む弗化炭化水素系物質の全廃が決定されている。空気調和機や冷凍機の冷媒として広く用いられているHCFC22もその対象であり、いわゆる特定フロンであるCFC類よりはオゾン層破壊に対する影響が小さいものの、数年以内に代替することが要求されている。◆現在、HCFC22等の従来冷媒の代替候補として検討されている新冷媒として、例えばオゾン層破壊の原因である塩素を含まない弗化炭化水素のHFC32、HFC125、HFC134a、HFC143a、HFC152aいずれか、あるいはそれらの中のいくつかを混合した複数混合冷媒が有望と考えられている。

【0004】ところで、今後新冷媒対応製品が市場に投入されたとしても、すでに設置され稼働しているものに加えて、切り替えまでの当面の間製造・販売されているものを合わせ、相当数の機器が従来機として稼働することになるが、従来冷媒は製造の中止や縮小により入手困難となること、規制の強化により使用が困難になることが予想され、その代替が必要となることは上述の通りである。したがって、既存機器を有効に使用して、最小限の変更で新冷媒に対応することが必要となってくる。

【0005】そこで、冷媒と冷凍機油が変わることにより必要になると思われる機器の変更点を具体的にあげると、おしのけ容積や圧縮比等の圧縮機諸元、圧縮機運転周波数制御方法や膨張装置絞り量、冷凍サイクル制御用バイパス流量、受液器やアキュムレータ等の容器類容積、熱交換器容量、熱交換器バス配列、部品の耐圧構造、圧縮機給油量、アキュムレータ返油量、配管径、新冷媒／新冷凍機油対応材料の使用、水分を含み易い冷凍機油には水分を吸着する乾燥剤の使用等がある。

【0006】ところで、新冷媒は従来冷媒に近い特性のものを指向しており、このため前記変更点全てについて変更しなくても、既存機器の一部あるいは大部分を流用して新冷媒に対応できる可能性がある。前記変更点の中では、膨張装置絞り量、熱交換器容量、熱交換器バス配

列、部品の耐圧構造、配管径、新冷媒／新冷凍機油対応材料をそのまま使用できれば、少なくとも室内機と冷媒配管は変更する必要がない。これについては、例えばHFC32／HFC125／HFC134aの混合冷媒を使用することで、性能の多少の低下を伴うものの、室内機および冷媒配管は従来冷媒使用機器をそのまま使用できる可能性が高い。そして、残りの変更点は室外機に属するものであり、室外機を丸ごと交換してしまえば、機器については新冷媒に対応した空気調和機に変えることができる。

【0007】一方、冷媒が変わると、冷凍機油もそれに対応したものに変わる必要が生じる。しかしながら、上述の新冷媒は鉱物油やアルキルベンゼン等を主体とする従来冷凍機油に対して相溶性が著しく低いので、従来の冷凍機油とともに使用することができない。そこで、エーテル系やエステル系等分子極性により新冷媒との相溶性を確保した新冷凍機油が用いられることとなる。

【0008】ところで、新冷媒を適用した冷凍サイクル中に、塩素系物質を含む従来冷凍機油や従来冷媒が残留や混入すると、新冷媒や新冷凍機油の化学的变化の原因となる。例えば、酸の発生による冷凍サイクル内材料の腐食があげられ、製品の信頼性を著しく低下させる恐れがある。また、従来の機器に使用されている、従来冷媒や従来冷凍機油との相性が確認されている全ての材料が、新冷媒と新冷凍機油についても問題なく使用できるとは限らず、腐食や膨潤による機器の損傷やシール性の低下が生じる可能性がある。さらに、新冷媒と相溶性のない従来冷凍機油が多量に残留していると、蒸発器内が低温であることによりワックス分の分離が生じて、管内付着による伝熱性能の低下や詰まりの原因になる。つまり、機器と冷媒の交換を単に行っただけでは、信頼性と性能を確保できない恐れがある。したがって、従来冷媒を使用した既存機器を流用して、新冷媒に対応させる場合には、上記の点に配慮した方法が必要となる。

【0009】また、前述のようにHCFC22等の従来冷媒は、影響の程度の違いはあってもオゾン層を破壊するので、大気中への放出を極力避ける必要がある。◆さらに、新冷媒に対応させるために室外機あるいは室内機を新冷媒対応機器に変更すると、制御用の信号伝送線の必要配線数や、接続部コネクタ形状を変えなければならない恐れがある。その上、伝送される情報の内容や制御信号のフォーマットが異なっていることも考えられ、室外機と室内機、および制御信号伝送線の不適合で、機器の接続ができない恐れもある。

【0010】本発明の目的は、従来冷媒を使用していた既存機器を流用して、最小限の変更で、容易にかつ経済的に冷凍サイクルを新冷媒に対応したものに変更する方法を提供することにある。

【0011】本発明の他の目的は、従来冷媒を使用していた既存機器を流用して新冷媒に対応するように変更し

ても、機器の信頼性を確保しかつ性能を損なわない、空気調和機の冷媒変更方法を提供することにある。

【0012】本発明の更に他の目的は、特殊な装置を使用することなく、極力冷媒を大気中に放出しないでオゾン層を破壊せず、リサイクルをも可能として、環境に害を与えずかつ経済的な、空気調和機の冷媒変更方法を提供することにある。

【0013】本発明の他の目的は、従来冷媒を使用していた既存機器を流用して新冷媒に対応するように変更するとき、変更した新冷媒対応機器と、流用する制御信号伝送線あるいは室内機との間に、制御信号伝送上の不適合部分があっても、これらの機器を変更することなく接続できるようにした空気調和機の冷媒変更方法を提供することにある。

【0014】

【課題を解決するための手段】上記課題を解決するために、室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系冷媒に変更する空気調和機の冷媒変更方法において、前記室外機中に前記塩素を含む弗化炭化水素系冷媒を内蔵したまま回収運転を行った後に、前記室外機を前記塩素を含まない弗化炭化水素系冷媒に適合した新冷凍機油を内蔵した新室外機に置換し、前記室外機と前記室内機とを真空引きし、前記塩素を含まない弗化炭化水素系冷媒を前記空気調和機に封入した後、所定時間だけ前記空気調和機を運転し、その後に前記塩素を含まない弗化炭化水素系冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返すようにしたものである。

【0015】また、室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系冷媒冷媒に変更する空気調和機の冷媒変更方法において、前記室外機と前記室内機を接続する液冷媒配管及びガス冷媒配管と、制御信号伝送線との中の少なくとも1つをそのまま流用し、前記室外機と前記室内機とを、前記塩素を含まない弗化炭化水素系冷媒に対応した新室外機及び新室内機に置換した後に真空引きし、前記塩素を含まない弗化炭化水素系冷媒を封入したものである。

【0016】さらに、室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系混合冷媒に変更する空気調和機の冷媒変更方法において、前記室外機中に前記塩素を含む弗化炭化水素系冷媒を内蔵したまま回収運転を行った後に、前記室外機を前記塩素を含まない弗化炭化水素系混合冷媒に適合した新冷凍機油を内蔵した新室外機に置換し、前記室外機と前記室内機とを真空引きし、前記塩素を含まない弗化炭化水素系混合冷媒の少なくとも1成分を有する洗浄冷媒を前記空気調和機に封入した

後、所定時間だけ前記空気調和機を運転し、その後に前記洗浄冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返すものである。

【0017】また、室内機及び室外機を備えた空気調和機の作動冷媒を塩素を含む弗化炭化水素系冷媒から塩素を含まない弗化炭化水素系冷媒に変更する空気調和機の冷媒変更方法において、前記室外機中に前記塩素を含む弗化炭化水素系冷媒を内蔵したまま回収運転を行った後に、前記室外機を前記塩素を含まない弗化炭化水素系冷媒に適合した新冷凍機油を内蔵した新室外機に置換し、前記室外機と前記室内機とを真空引きし、前記塩素を含まない弗化炭化水素系冷媒を前記空気調和機に封入した後、所定時間だけ前記空気調和機を運転し、その後に前記塩素を含まない弗化炭化水素系冷媒と前記新冷凍機油とを入替える入替え作業を行い、前記所定時間の運転と前記入替え作業からなる洗浄運転を所定回数以上繰り返した後に冷媒が変更されたことを示す表示物を前記空気調和機に設置するものである。

【0018】

【作用】空気調和機の冷媒を規制に適合するものに変更するにあたり、室外機と、冷媒配管と、制御信号伝送線とをそのまま流用し、室外機を、塩素を含まない新冷媒に対応した、圧縮機と、制御装置と、絞り装置と、熱交換器と、冷凍サイクル配管と、前記新冷媒に適応する新冷凍機油を内蔵した新室外機に置換することにより、室外機以外の機器の入換え作業が不要となる。そのため、取替え部品代の低減、工事代の低減および工事期間の短縮が図られる。◆また、交換するのが新冷凍機油を封入した新冷媒に対応する圧縮機だけの場合には、より低コスト化が可能となる。◆さらに、液冷媒配管、あるいはガス冷媒配管、あるいは制御信号伝送線のいずれかまたは全てをそのまま流用する場合には、室外機と室内機のみを置換すればよく、交換の比較的容易な部分の作業が主体となり、配管や配線を引き回す面倒な作業が不要となる。

【0019】また、塩素を含まない新冷媒の熱物性に不適合であるか、あるいは塩素を含まない新冷媒、あるいは塩素を含まない新冷媒に対応可能な新冷凍機油に不適合な材料を用いた空気調和機の冷凍サイクル部品を、塩素を含まない新冷媒の熱物性に適合し、かつ塩素を含まない新冷媒および新冷凍機油との混在使用が可能な進冷凍サイクル部品に交換することで、他の大部分の構成機器をそのまま流用でき、低コスト化が可能となる。◆また、室外機中の塩素を含む弗化炭化水素系冷媒の回収運転を行うことにより、ほとんどの冷媒を大気中に放出することがなく、オゾン層の破壊を抑制すると共に、専用の冷媒回収装置等の機械を用いることなく、容易に冷媒を回収できる。さらに、一定時間空気調和機を運転し、その後に塩素を含まない新冷媒と新冷媒に適合する

新冷凍機油と入れ換えることを一連の作業とする洗浄運転を冷媒交換時に実施する。そして、この一連の作業を冷凍サイクル中に残留する塩素を含む弗化炭化水素系冷媒および塩素を含む弗化炭化水素系冷媒に適合した従来冷凍機油の濃度が許容濃度以下になるまで繰り返すので、残留している従来冷凍機油が圧縮機に戻り、冷凍サイクル中の残留従来冷凍機油濃度が薄まる。これにより、従来冷媒および従来冷凍機油の残留量は微量となり、従来冷媒および従来冷凍機油の残留による酸発生やワックス分の析出を防止でき、酸分による機器内材料の腐食起因するモータ焼損事故や、軸受寿命低下、摺動部の腐食摩耗増加による機器の破損を防止できる。また、蒸発器管壁内に付着したワックス分により、伝熱性能の低下、管内圧損の増加による空調能力および効率の低下等を防止できる。

【0020】さらに、2成分以上の混合成分からなる塩素を含まない新冷媒に変更するための洗浄運転において、新冷媒を構成する成分のうちの一つの成分の冷媒のみを洗浄運転に用いると、単位知性文の冷媒に比べ高価な新冷媒の使用量を減らすことができ、安価となる。

【0021】また、流用する制御信号伝送線と交換した室外機あるいは室内機との間に、制御信号伝送線接続コネクタの変換コネクタあるいは伝送信号フォーマットを変換する変換装置を取り付けると、流用する制御信号伝送線と、交換した新冷媒対応室外機あるいは室内機のコネクタ形状不一致による接続不可、あるいは配線端末加工作業が不要となる。なお、室内機は流用し、室外機のみを交換すると、伝送情報の内容やフォーマットが異なっているとしても、室外機からの伝送情報は従来冷媒使用機器の伝送信号フォーマットに変換される。逆に、室内機からの伝送情報は新冷媒対応機器の伝送信号フォーマットに変換される。伝送情報の内容に不足がある場合は適宜ダミーデータを挿入することにより、伝送エラーによる機器停止を防止でき、流用する従来機器および交換する新冷媒対応機器の改造が不要となる。

【0022】また、従来冷媒から新冷媒への冷媒交換作業が終了した後、冷媒が変更されたことを示す表示物を空気調和機に設けると、新冷媒への冷媒交換作業が終了した後に、再び冷凍サイクルのメンテナンス作業が必要になったときにも、外見からは従来冷媒使用機器に見える当該空気調和機に対し、表示物が既に新冷媒に対応していることを明示しているので誤差を防止できる。そして、従来冷媒の再封入による機器の破損や劣化を防止できる。

【0023】

【実施例】初めに、図8、図9にしたがい、従来の空気調和機について説明する。◆図8は、従来の空気調和機の機器構成を示した図であり、動作流体にHCF C 22を用いている。そして、一台の室外機に対して室内機が複数ある、ビル用マルチパッケージ空気調和機の一例で

ある。室外機10qには、圧縮機1q、室外熱交換器2q、室外送風機3q、室外膨張装置4q、四方弁5q、アキュムレータ6q、受液器7q、ガス側阻止弁11q、液側阻止弁12q、液側チェックバルブ13q、およびこれらを連結する冷媒配管と、冷凍サイクルの圧力および温度、室内制御装置24a、24b、24cからの各種情報により、圧縮機1q、室外送風機3q及び室外膨張装置4q等を制御する室外制御装置8qが含まれ、その主要部品が一つの筐体中に収容されている。

【0024】一方、複数の室内機20a、20b、20cには各々冷媒配管で連結された、室内熱交換器21a、21b、21cと室内膨張装置23a、23b、23cと、吸い込み温度、吹き出し温度、リモコンスイッチ25a、25b、25c、または室外制御装置8qからの情報により室内送風機22a、22b、22cと室内膨張装置23a、23b、23cとを制御する室内制御装置24a、24b、24cとを備えており、それぞれ筐体中に収容されている。これら室外機10qと室内機20a、20b、20cとは、ガス冷媒配管31および液冷媒配管32により接続されている。さらに、室外制御装置8qと室内制御装置24a、24b、24cとの間を、制御信号伝送線33が渡り接続されている。また室内機20a、20b、20cには、冷房運転時に室内熱交換器21a、21b、21cに結露する水分を排水するドレン配管34が設けられている。なお、室外制御装置8q、室内制御装置24a、24b、24cには、それぞれ電源からの室外電源配線35qと室内電源配線36a、36b、36cとが接続されていて、電力が供給されている。

【0025】図9は、従来の空気調和機の、室内機据え付け状態を示す図（作業員は図示せず）であり、設置スペースを取らない利点により近年室内機の主流を占めている天井埋め込みカセットタイプの室内機を取り付ける様子を示している。室内機40に接続されたガス冷媒配管41、液冷媒配管42および制御信号伝送線43が一括され、その周囲を断熱材でくまわれて屋上にある室外機と接続される。また、各ドレン配管44は他の室内機のドレン配管と連結されて一本の配管となり、排水設備に接続される。これらの配管配線類は、図9の如く天井裏あるいは壁中に埋設されている。◆ビル用マルチパッケージ空気調和機では、このような室内機が同一階に数台から数十台設けられ、さらにそれが多数階にまたがるため、これら配管類の施工だけでかなりの作業を伴う。しかも、新築物件に設置する場合は、これら配管類の施工作業を内装工事の開始前に済ますことができ、天井や壁面がなく比較的容易に設置できるが、一旦、設置された後では天井や壁に隠蔽されるうえ、室内が本来の用途に使用されているので作業がしにくい。

【0026】このようなすでに設置されている従来冷媒使用空調機を、新冷媒に対応させる方法を、図1ないし



図4、および図8を用いて説明する。◆図1は、本発明の一実施例の作業フロー図である。図2は、本発明の一実施例の機器構成を示した図であり、図8との違いは、室外機10qを新冷媒に対応した新室外機10に交換したことにある。すなわち、圧縮機1、室外熱交換器2、室外送風機3、室外膨張装置4、四方弁5、アキュムレータ6、受液器7、ドライヤ9、ガス側阻止弁11、液側阻止弁12、液側チェックバルブ13およびこれらを連結する冷媒配管と、冷凍サイクルの圧力、温度や室内制御装置24a、24b、24cからの情報により、圧縮機1、室外送風機3、室外膨張装置4等を制御する室外制御装置8等が一つの筐体中に収容されている。そして、圧縮機1には、あらかじめ新冷媒に対応した新冷凍機油、例えばポリオールエステル系オイルが封入されている。図3は、本発明の一実施例の室外機交換作業状況を示した図である。また、図4は、本発明の一実施例の洗浄回数とHCFC22残留濃度の関係を示す図である。

【0027】以下、このように構成した本発明の一実施例について、その作業手順を図1の作業フロー図にしたがい、順次説明する。◆初めに（第1のステップ）、従来冷媒であるHCFC22の冷媒回収運転を行う。これは、冷凍サイクル中の従来冷媒および従来冷凍機油を、なるべく大気中に放出しないで室外機10qを取り外すために行うものである。その手順は、まず、室外機10qの液側阻止弁12を閉じて冷房の試運転モードにし、しばらく運転する。試運転モードは、従来の空気調和機に通常備えられている機能であり、室内機のON/OFF、設定温度に拘わらず、連続して運転するモードである。液側阻止弁12qを閉じた状態で冷房運転を行うと、室外熱交換器に凝縮した液冷媒が室内機に流れることができないので、徐々に室外機10q中に冷媒が回収されていく。保護装置が動作しない範囲で運転を続け、頃合を見計らいガス側阻止弁11qを閉じた後、試運転モードを解除し停止する。この作業により、冷凍サイクル中の冷媒の大部分は室外機に回収された状態となる。室内機と配管中に残ったわずかの冷媒を放出した後、室外機10qをガス冷媒配管31及び液冷媒配管32から取り外せば、大気中に放出される冷媒を最小限にとどめて、冷媒回収専用装置等を用いることなく冷媒を回収できる。

【0028】次に（第2のステップ）、室外機を交換する。従来冷媒を取り除いた旧室外機10qを、新冷媒、例えばHFC32/HFC125/HFC134a混合冷媒に対応した新室外機10と交換し、ガス冷媒配管31、液冷媒配管32、制御信号伝送線33を連結する。新室外機10では、新冷媒の熱力学特性や輸送特性等の物性に適合する新冷凍機油、例えばポリオールエステル系オイルの特性に合致する必要がある。そのため、おし

御方法や膨張装置絞り量制御方法、冷凍サイクル制御用バイパス流量、受液器やアキュムレータなどの容器類容積、熱交換器容量、バス配列、部品の耐圧構造、圧縮機給油量、アキュムレータ返油量、配管径、新冷媒/新冷凍機油対応材料の使用、水分を吸着するドライヤの設置等の点を旧室外機から変更している。圧縮機、熱交換器、制御装置等をパッケージ化した室外機を交換することにより、交換作業を容易に実施できる。

【0029】交換作業の一例として、屋上に設置されている図2に示した室外機において、クレーンを用いて従来室外機と新室外機を搬出、搬入する。ここで、取り外した室外機10qは、そのまま機器メーカーに送る。そこで、機器メーカーあるいはリサイクル業者は冷媒の取り出し作業、および新冷媒対応部品への部品交換作業を行う。これにより、冷媒および機器のリサイクルによる省資源化、環境汚染の防止が図られる。なお、本実施例では室外機のみで新冷媒使用に対応できる例を示したが、室内機も新冷媒対応機器に交換する必要がある場合には、このときに室内機20a、20b、20cを新冷媒対応室内機に交換する。

【0030】次のステップ（第3のステップ）では、真空引きを行い新冷媒を封入する。すなわち、室内機20a、20b、20cとガス冷媒配管31と液冷媒配管32中の空気および冷凍サイクル内に残留する従来冷媒を排出する真空引きが終了したら、ガス側阻止弁11、液側阻止弁12を開き、新冷媒を封入する。◆さらに次のステップ（第4のステップ）は、洗浄運転である。これは、先に実施した試運転モードで空気調和機を所定時間運転して、冷凍サイクル中に新冷媒と新冷凍機油を循環させるもので、冷媒と冷凍機油の循環により室内機20a、20b、20cとガス冷媒配管31と液冷媒配管32中に残留している従来冷凍機油を圧縮機に戻し、残留濃度を薄めるものである。洗浄運転を実施する所定時間としては、冷凍機油が冷凍サイクル内をおおむね一巡する程度を考慮し、例えば2時間とする。所定時間経過後、空気調和機を停止する。◆次のステップ（第5のステップ）では、冷媒と冷凍機油を入れ替える。冷媒を液側阻止弁12等から回収するとともに、圧縮機1を新室外機10より取り外して圧縮機1内にある冷凍機油を排出する。そして未使用の新冷凍機油を圧縮機1に封入して、新室外機10に戻す。さらに真空引きを実施して、新冷媒を封入する。◆この第5のステップと更にもう1つ前の第4のステップとを繰り返すことにより、冷凍サイクル中に残留する従来冷媒および従来冷凍機油は、初期残留量より徐々に減少していく。この作業を所定回数繰り返して、従来冷媒および従来冷凍機油の残留濃度が、機器の信頼性を維持できる範囲まで微量となるようにする。

【0031】ここで、旧冷媒の回収作業に必要な所定回数について説明する。新冷媒および新冷凍機油を使用す



る冷凍サイクル内に、従来冷媒を含む塩素系物質が存在することは、新冷媒を分解劣化させて酸分を発生させる原因となる。この酸分の許容発生量は、冷凍サイクルに用いられる材料の腐食に影響を与えない程度であるとして、この条件の下に従来冷媒を含む塩素系物質の残留濃度の許容レベルを、圧縮機寿命試験等から実験的あるいは理論的に決定する。一方、冷媒および冷凍機油を入れ換えて洗浄運転を繰り返すことで、冷凍サイクル中に残留する従来冷媒および従来冷凍機油の残留量の減少していく様子を実機にて予め試験的に確認する。冷媒および冷凍機油を交換して洗浄運転した後に、冷媒および冷凍機油を抜き取り、HCF<sub>2</sub>2を含む塩素系物質をガスクロマトグラフにより検出するか、中和価試験方法による酸分含有量を測定することで、それらの変化を定量的に把握する。これらのデータから、従来冷媒を含む塩素系物質の残留濃度が、許容レベル以下となる冷媒および冷凍機油の交換回数と洗浄運転の回数を定めることができる。

【0032】冷媒および冷凍機油の交換回数と、洗浄運転後の冷凍サイクル内のHCF<sub>2</sub>2を含む塩素系物質の濃度の関係の例を、図4に示す。許容レベルは、機器の信頼性の低下に影響ない塩素系物質の最大濃度であり、本図の場合、冷媒および冷凍機油の交換を3回実施すれば、塩素系物質濃度は許容レベル以下となることがわかる。ただし、本実施例では、室外機を交換し、新冷媒を封入した1回目の冷媒および冷凍機油の交換を含んでいるので、前記所定回数は2回となる。

【0033】なお、本来なら個々のケースに対して、洗浄運転を行う都度、塩素系物質濃度を測定して冷媒および冷凍機油の交換をすれば確実であるが、塩素系物質濃度測定のための測定機の持ち込みが難しく、またサンプルを持ち帰り測定する時間的余裕もない実際の現場では、上記のように予め決めた交換回数で洗浄運転を実施するのが、最も合理的である。

【0034】ところで、本実施例では最終的に新冷媒としてHFC32/HFC125/HFC134a混合冷媒を動作流体に用いる空気調和機に変更することを目指している。しかし、洗浄運転では冷凍サイクル中の塩素系物質回収が目的であり、この作業中には空気調和の必要がないので、洗浄運転に用いる冷媒には冷凍能力が要求されない。したがって、最終的に使用する冷媒以外の冷媒を用いて洗浄運転を実施することもできる。特に本実施例のように混合冷媒を用いる場合は、その成分中の1成分である冷媒を単独で用いて洗浄すれば、安価な冷媒で洗浄できるとともに、材料や冷凍機油との適合性も確認されている物質なので適用に関しての不都合もない。ただし、混合冷媒中の成分の中には、燃焼性の高いものや入手が困難な物もあるので、この点への配慮が必要である。

【0035】本実施例では、CFC12の代替冷媒とし

ていち早く実用化し、入手性や価格面で優れるHFC134aが最も適している。そこで、第3のステップの冷媒の封入の時からHFC134aを封入して洗浄運転を行い、第5のステップで入れ換える冷媒にもHFC134aを用いて繰り返し洗浄運転する。洗浄運転が所定回数に達した後の最後の冷媒交換の時に、最終冷媒であるHFC32/HFC125/HFC134a混合冷媒を封入する。これにより、洗浄作業には安価な冷媒を用いることができ、経済的に冷媒を変更できる。◆同様に、洗浄運転に用いる冷凍機油に関しても、同様に機器の使用に問題を生じさせない程度に潤滑性能や耐久性能を落とした、安価な冷凍機油を用いることもできる。さらに洗浄用途に限定して、低粘度で流動性が良く管内に付着する従来冷凍機油の回収性を向上したり、塩素分補足剤や酸補足剤等の添加物を含有して、洗浄回数を減らす機能のある洗浄専用冷凍機油を使用することもできる。◆以上のように、洗浄運転およびその後の冷媒と冷凍機油の交換の回数が、所定回数に達すれば新冷媒への冷媒変更作業を終了し、以後は通常の運転を行う。このようにして従来冷媒と従来冷凍機油の組合せから新冷媒と新冷凍機油への組合せへ転換が図られる。

【0036】次に、本発明の他の実施例について、その実施手順を図5の作業フロー図に従い説明する。図5が前述の実施例と相違しているのは、従来機器から交換するものが圧縮機1qだけであり、また第1のステップの冷媒回収運転では冷媒回収専用装置を用いる点である。その他については前述の実施例と同様である。すなわち、冷凍機油が含有している水分から酸分が発生しない新冷凍機油を使用し、ドライヤの設置が不要な場合、あるいは、電子膨張弁が圧縮機吐出ガス冷媒過熱度に基づいて制御され、インバータや複数圧縮機の選択運転による圧縮機容量制御は室内機吹き出し温度に基づく場合など、新冷媒の熱物性が従来冷媒に近い場合で制御装置も従来冷媒のものがそのまま使用できる場合である。本実施例では、交換する機器が圧縮機だけなので、運搬物量が少なく容易な作業で新冷媒に対応できる。◆なお、熱物性の違いに対応させるために、電子膨張弁や圧縮機インバータ運転周波数等の制御ソフトを新冷媒に適応したものに替え、室外制御装置8を交換してもよい。また、残留水分が問題であれば、冷媒配管途中に接続できるドライヤを取り付けても良い。いずれも部品としては軽量で、かつ容易に交換や取付ができるものを用いることが可能である。

【0037】次に、本発明の他の実施例を図6に示す。制御信号交換装置18を制御信号伝送線33と新室外機10の間に取り付けたこと以外は、図2の実施例の機器構成図と同じである。◆本実施例は、前述の図2の実施例のように、室外機を交換して新冷媒に対応させる場合に、室外制御装置8と制御信号伝送線33の接続部のコネクタ形状が異なったり、室外制御装置8と室内制御装

置24a、24b、24cが送受信する伝送情報の内容やフォーマットが異なるために、機器の接続がそのままではできない時に適用される。

【0038】ここで、制御信号変換装置18の動作を説明する。制御信号変換装置18は、制御信号伝送線33を接続できるコネクタ形状を有し、また室外制御装置8に接続できるコネクタ形状の伝送線を有している。そして、室外制御装置8と制御信号伝送線33の間に接続され、伝送情報を連絡可能にする。さらに、制御信号変換装置18は、室外制御装置8からの伝送情報を従来冷媒使用機器の伝送信号フォーマットに変換して室内制御装置24a、24b、24cに送信し、逆に室内制御装置24a、24b、24cからの伝送情報を新冷媒対応機器の伝送信号フォーマットに変換して室外制御装置8に送信する。この際、伝送情報の内容に不足がある場合は、適宜ダミーデータを挿入して、伝送情報を送信する。これにより伝送エラーを生じることがなく、また流用する従来機器および交換する新室外機10の改造をすることなく、新冷媒に対応可能である。

【0039】次に、本発明のさらに他の実施例を図7に示す。図7は、表示物の例を示す図である。◆従来冷媒を使用した既存機器を流用して、動作流体を塩素を含まない新冷媒に変更した空気調和機のサービス作業時に目につく場所、例えば室外機外面に図6のような表示物を張り付ける。この表示物は、少なくともこの空気調和機の動作流体が新冷媒に変更されていること、および適用した新冷媒、新冷凍機油の名前表示をしている。この表示物により、新冷媒への冷媒交換作業が終了した後しばらくして、再び冷凍サイクルを分解してメンテナンスを行うときに、外見からは従来冷媒使用機器に見える当該空気調和機であっても、この表示物がすでに新冷媒に対応している注意を促す効果があり、新冷媒に対応した機器に再び変更してしまうこととか、誤って従来冷媒を再封入してしまうことを防止できる。

【0040】

【発明の効果】本発明によれば、空気調和機において塩素を含む旧冷媒から塩素を含まない新冷媒に冷媒を変更する際に、リブレースする部品を極力少なくすることができるので安価に冷媒変更ができると共に、短時間の作業しか必要とせず、経済的に空気調和機を新冷媒対応に変更することができる。

【0041】また、本発明によれば、ほとんどの冷媒を

大気中に放出しないで回収できるので、オゾン層の破壊を抑制できると共に、専用の冷媒回収装置等を必ずしも必要とせず、容易に冷媒を回収できる。そして、回収した希少価値がある冷媒を、リサイクルに役立てることができるので、環境破壊を極力避けて、経済的に空気調和機を新冷媒に対応させることができる。

【0042】さらに、本発明によれば、酸分による機器内材料の腐食が原因の絶縁破壊等の事故を防止できると共に、伝熱性能の低下、管内圧損の増加による空調能力および効率の低下等を防止でき、機器の信頼性および性能の向上が可能となる。

【0043】

【図面の簡単な説明】

【図1】発明の一実施例の作業フロー図である。

【図2】本発明の一実施例の機器構成図である。

【図3】本発明の一実施例の室外機交換作業状況図である。

【図4】本発明の一実施例の洗浄回数とHCFC22残留濃度の関係を示す図である。

【図5】本発明の他の実施例の作業フロー図である。

【図6】本発明の他の実施例の機器構成図である。

【図7】本発明のさらに他の実施例の表示物の例を示す図である。

【図8】従来の空気調和機の機器構成図である。

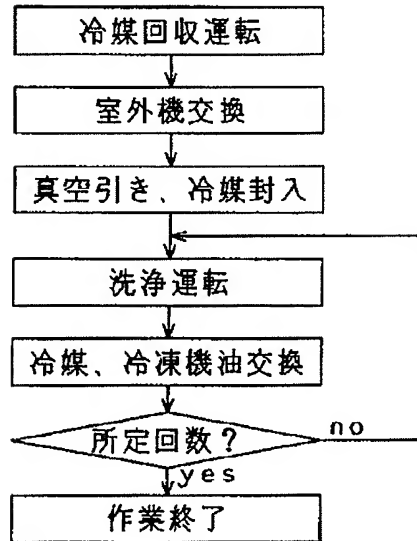
【図9】従来の空気調和機の室内機据え付け状態を示す図である。

【符号の説明】

1、1q…圧縮機、2、2q…室外熱交換器、3、3q…室外送風機、4、4q…室外膨張装置、5、5q…四方弁、6、6q…アキュムレータ、7、7q…受液器、8、8q…室外制御装置、9…ドライヤ、10…新室外機、10q…室外機、11、11q…ガス側阻止弁、12、12q…液側阻止弁、13、13q…液側チェックバルブ、18…制御信号変換装置、20a、20b、20c…室内機、21a、21b、21c…室内熱交換器、22a、22b、22c…室内送風機、23a、23b、23c…室内膨張装置、24a、24b、24c…室内制御装置、25a、25b、25c…リモコンスイッチ、40…室内機、41…ガス冷媒配管、42…液冷媒配管、43…制御信号伝送線、44…ドレン配管。

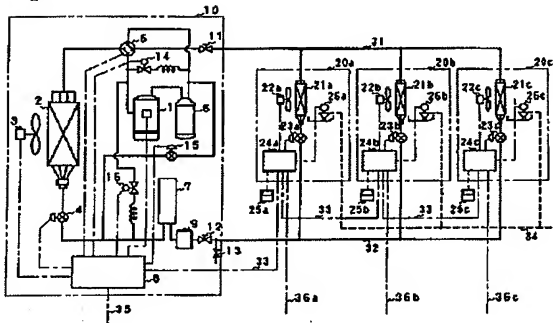
【図1】

図1



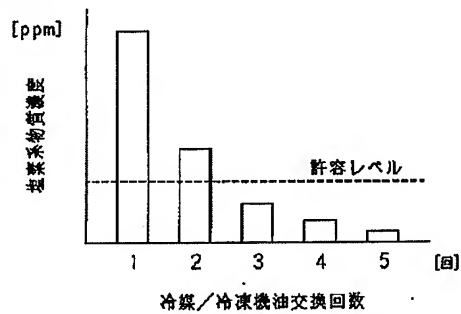
【図2】

図2



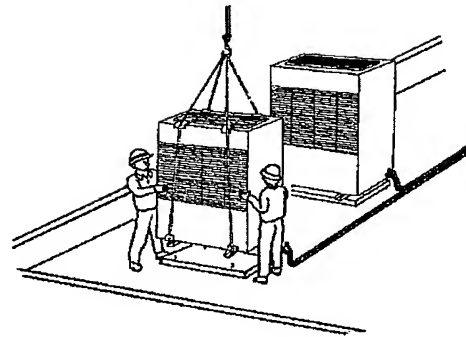
【図4】

図4



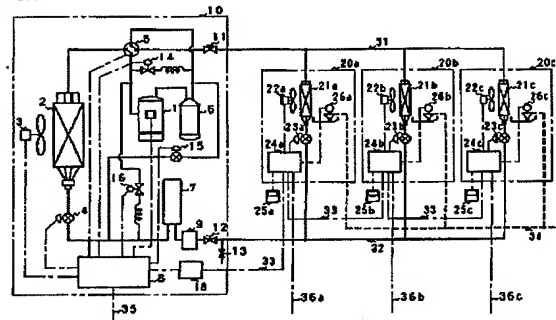
【図3】

図3



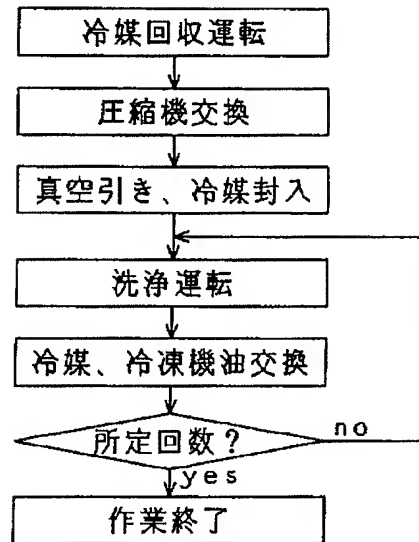
【図6】

図6



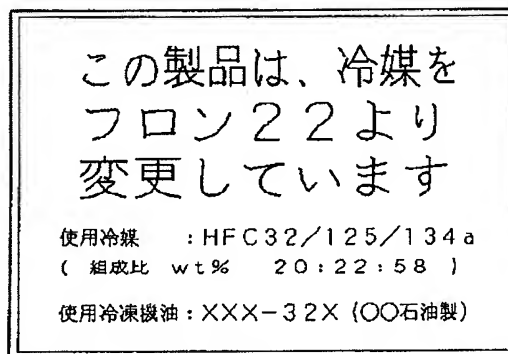
【図5】

図5

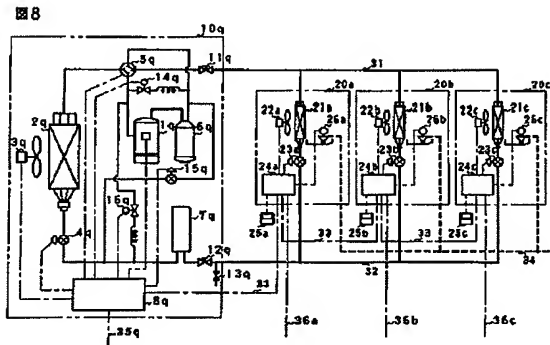


【図7】

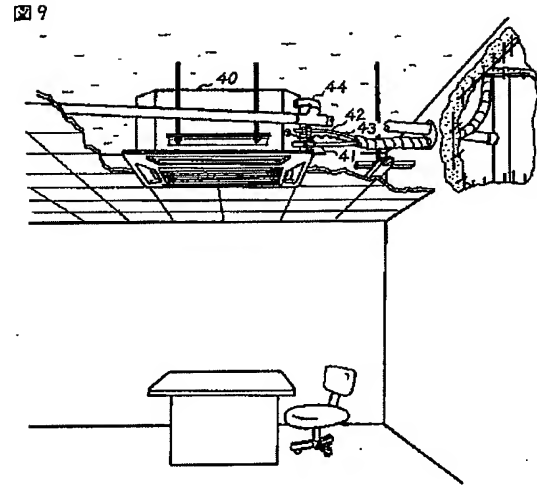
図7



【図8】



【図9】



フロントページの続き

(72)発明者 小国 研作  
茨城県土浦市神立町502番地 株式会社日  
立製作所機械研究所内

(72)発明者 松嶋 弘章  
茨城県土浦市神立町502番地 株式会社日  
立製作所機械研究所内  
(72)発明者 小暮 博志  
栃木県下都賀郡大平町大字富田800番地  
株式会社日立製作所リビング機器事業部内